Responding to the Challenges of Energy and Greenhouse Gas Reductions from Transportation

A summary of the major findings from "On the Road in 2035,"
a recently issued report by Professor John Heywood,
Director, Sloan Automotive Laboratory at M.I.T. and his colleagues

Professor Heywood has been leading a substantial research effort for the last several years focused on our options for reducing petroleum consumption and greenhouse gas (GHG) emissions from transportation. The results of this study make clear that fuel consumption and GHG emissions of our U.S. light-duty vehicle fleet can be reduced significantly. How rapidly that reduction occurs depends on the determination of the major stakeholder groups—vehicle and fuel suppliers, vehicle and fuel purchasers and users, and governments—to vigorously undertake the actions required.

Worldwide demand for transportation services is growing inexorably, and we foresee no single major development that alone can resolve the growing problems of vehicle fuel consumption and GHG emissions. Thus, progress must come from a comprehensive effort to 1) develop and market more efficient vehicles and more environmentally benign fuels, 2) find more sustainable ways to satisfy demands for transportation services, and 3) prompt all of us who use our vehicles and other transportation options to reduce our consumption. All of these changes will need to be implemented at very large scale to achieve significant reductions in petroleum, energy, and GHG emissions. Implementation will increase the cost of transportation to ultimate users, and will require government policies to encourage or require moving toward these goals while sharing the burdens more equitably and attempting to minimize total social costs. Our report's specific findings are summarized below.

1. The time scales for such changes vary, but all are long. Thus, a comprehensive strategy should include actions designed to achieve fuel and emissions reductions in the near term (up to 15 years), in the mid-term (15–30 years), and in the long term (more than 30 years). The preparatory work for both mid- and long-term efforts—including extensive research and development—must begin now if we are to ensure that these efforts will be ready to be implemented as soon as they become practical.

2. An especially promising opportunity is the development and deployment of more efficient propulsion systems—engines and transmissions. Improvements of 25-40% are potentially feasible over the next 10-25 years. Critical here is the need to use propulsion system efficiency gains to reduce real-world vehicle fuel consumption, rather than offset increases in vehicle power and size. This poses a serious problem of marketability to customers since the long-term market trend has been toward increasingly powerful, larger, and heavier vehicles.

3. A second important opportunity to realize is vehicle weight and size reduction, along with reducing vehicle drag and tire rolling resistance. Weight reduction can be accomplished via the use of lighter materials and vehicle redesign. Vehicle size reduction can be attained by producing and popularizing smaller vehicles to replace larger ones. A 20% weight reduction in some 20 years may be feasible. While some aspects of vehicle functionality may be diminished, the basic mobility attractions of personal transportation can be maintained.

4. Alternative fuels do reduce petroleum consumption, but in the U.S. and Europe they are more likely to increase GHG emissions, in the near term at least, than decrease them. The near-term alternatives are derived from fossil raw materials (oil sands, heavy oils, coal, natural gas). Their recovery and refining emissions range from higher than to roughly break-even with petroleum, even using advanced technologies. In principle, biofuels can reduce GHG emissions significantly to the extent of potential biomass supply. But the overall environmental and economic benefits of biofuels are not yet clear. It is important that we encourage research and development on biofuels with promising environmental and economic prospects and be realistic about their potential contribution.

5. Government policies will be needed to further the overall objectives of our road transportation system as well as reduce its energy and environmental impacts. These policies should be structured to achieve the following:

   a. Both push development and deployment of appropriate technologies and generate market pull for those technologies with policies that reinforce each other. Incentives should be for outcomes, and not specific technologies such as current incentives for hybrids, which put other vehicles with low fuel use and emissions at a competitive disadvantage.

   b. Be transparent and appear fair to all stakeholders, especially those suffering the highest costs of the necessary transitions. Transportation-related taxes, fees, and credits should have clear objectives and be distributed equitably among stakeholders and user groups.

   c. Encourage conservation by users as they choose more efficient ways of using their transportation options, such as less aggressive driving, bundling of trips, and more carpooling.

6. Plug-in hybrid and fuel cell vehicles could be paths to diversify transportation's energy sources by using electricity and hydrogen in the mid- to longer-term. Due to current technology limitations, high cost, and infrastructure issues their feasibility is uncertain. However, along with biofuels, these transitions could potentially reduce greenhouse gas emissions significantly.

Overall, this report makes clear that we have many options available for reducing petroleum consumption and greenhouse gas emissions from private motor vehicles in the United States. By realizing these options, current consumption and emission growth patterns can be leveled off and reversed. However, not much will happen without appropriate policies to push and pull improved technologies and greener alternative fuels into the market place in high volume. And transitioning from our current situation onto a path with declining fuel consumption and emissions will take several decades—longer than we hope or realize.

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For more information please visit: http://web.mit.edu/sloan-auto-lab/research/beforeh2/

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